

**Water Body Fact Sheets for 2002
Section 303(d) List Update
Lahontan Region**

***WEST FORK AND EAST FORK CARSON RIVER
HYDROLOGIC UNITS***

**California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
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November 2001

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**WEST FORK CARSON RIVER, HEADWATERS TO WOODFORDS,
PHOSPHORUS
2002 Section 303(d) Fact Sheet
Listing**

Summary of Proposed Action

The segment of the West Fork Carson River between its headwaters and the community of Woodfords is proposed to be listed for phosphorus.

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	West Fork Carson River	Pollutant(s)	Phosphorus
Hydrologic Unit	West Fork Carson River (633.00)	Sources	Erosion, stormwater, atmospheric deposition
Total Length	~ 21 miles (in CA)	TMDL Priority	High
Size Affected	~15 miles	TMDL End Date	After 2015
Latitude/Longitude	38.778° N 119.821°W	Original 303(d) Listing Year	2002

Watershed Characteristics

The East and West Forks of the Carson River are located in Alpine County. The forks join to form the Carson River near Genoa, Nevada. Both the East and West Forks originate on the eastern side of the Sierra Nevada in or near federal wilderness areas. Most of the California portion of the Carson River watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. The Carson River watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality.

The West Fork originates in the Lost Lakes and flows through scenic Hope Valley, where public funds have recently been spent to acquire important wetland/riparian habitat and a restoration project to address the impacts of historic (pre-1989) grazing is under way. There are several small lakes at the headwaters of the West Fork, some of which are managed as reservoirs to support irrigation in the lower watershed. Water diversions are limited by the California-Nevada Interstate Water Compact and managed by a federal watermaster under a court decree. The drainage area of the West Fork Carson River upstream of the USGS gaging station near Woodfords is 65.40 square miles.

Development in the upper watershed includes campgrounds, Sorensen's Resort, a small subdivision, roads, and two inactive mines. At lower elevations, the river passes through the communities of Woodfords and Paynesville. Highway 88 is located near the West

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Fork from Hope Valley to the state line. Near Woodfords, the watershed is still recovering from the impacts of wildfire. Cattle ranching is important in the lower section of West Fork watershed, where pasturelands are irrigated with secondary wastewater effluent exported from the Lake Tahoe Basin.

Water Quality Objectives Not Attained

The water quality objective for total phosphorus in this segment of the West Fork Carson River is 0.02 milligrams per liter (mg/L), expressed as an annual mean of monthly means. This is a running average incorporating historical data. The phosphorus objective is based on data collected in 1981 and 1982. The staff report for the 1983 Basin Plan update states that Regional Board staff did not use storm event data collected by the U.S. Geological Survey in computing the objective.

Evidence of Impairment

Regional Board staff computed the mean of monthly means for phosphorus using data collected by the South Tahoe Public Utility District near Woodfords between 1981 and 2000. The means of monthly means during the assessment period beginning in 1997 were as follows: 1997, 0.09 mg/L; 1998, 0.03 mg/L; 1999, 0.02 mg/L, 2000, 0.03 mg/L. The 1997 figure and subsequent annual means were presumably skewed by the influence of the January 1997 flood, which was greater than a 100 year flood for this reach.

Extent of Impairment

The segment of the Carson River from its headwaters to Woodfords is proposed for listing. (There are some historical water quality data for Hope Valley, but there is currently no routine water quality monitoring above Woodfords.)

Potential Sources

Sources of phosphorus loading to the upper West Fork Carson River may include eroded sediment (from streambanks and from other sources such as road and highway maintenance, construction sites, and slopes denuded by forest fires), stormwater, and atmospheric deposition. (In the Lake Tahoe Basin, atmospheric deposition of phosphorus from road dust and wood ash has been identified as an important nonpoint source.) Zonge and Swanson (1996) measured stream bank erosion in Hope Valley and showed that incised stream banks retreated more than 10 inches during a wet year.

TMDL Priority

This TMDL is recommended for a high priority, with completion after 2015. Revision of water quality objectives for the West Fork Carson River, to express them as annual

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Headwaters to Woodfords, Phosphorus
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means rather than means of monthly means, may be considered before that time.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1983. *West Fork Carson River and Indian Creek Watersheds Water Quality Control Plan Update: 1983.*

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region.*

California Regional Water Quality Control Board, Lahontan Region 2001. Internal Memo from John Steude and Alan Miller to Judith Unsicker, *Summary of water quality analysis for potential CWA listing of the lower [sic] of the West Fork of the Carson River, Alpine County.*

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies.*

Nevada Division of Water Planning, no date. *The Flood of 1997, Final Report.*
Available on the Internet: <http://www.state.nv.us/cnr/ndwp/flood-97/floodana.htm>.

Liu, M.S., J.E. Reuter, and C.R. Goldman, 2001. *Seasonal Significance of Atmospheric Deposition of Phosphorus and the Sources of Deposition for Lake Tahoe, CA-NV.*
Abstract of paper presented at meeting of American Society of Limnology and Oceanography, Albuquerque NM, February 2001.

South Tahoe Public Utility District. Unpublished water quality data.

Zonge, L. and S. Swanson, 1996. Changes in Streambanks in the Sierra Nevada Mountains: Perspectives from a Dry and a Wet Year. *Restoration Ecology* 4(2): 192-199.

**WEST FORK CARSON RIVER, HEADWATERS TO WOODFORDS,
NITROGEN
2002 Section 303(d) Fact Sheet
Listing**

Summary of Proposed Action

The segment of the West Fork Carson River upstream from Woodfords is proposed to be listed for violation of the water quality objective for total nitrogen.

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	West Fork Carson River	Pollutant(s)	Nitrogen
Hydrologic Unit	West Fork Carson River (633.00)	Sources	Erosion, stormwater, atmospheric deposition
Total Length	~21 miles (in CA)	TMDL Priority	High
Size Affected	~15 miles	TMDL End Date	After 2015
Latitude/Longitude	38.778° N, 119.821°W	Original 303(d) Listing Year	2002

Watershed Characteristics

The East and West Forks of the Carson River are located in Alpine County. The forks join to form the Carson River near Genoa, Nevada. Both the East and West Forks originate on the eastern side of the Sierra Nevada in or near federal wilderness areas. Most of the California portion of the Carson River watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. The Carson River watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality.

The West Fork originates in the Lost Lakes and flows through scenic Hope Valley, where public funds have recently been spent to acquire important wetland/riparian habitat and a restoration project to address the impacts of historic (pre-1989) grazing is under way. There are several small lakes at the headwaters of the West Fork, some of which are managed as reservoirs to support irrigation in the lower watershed. Water diversions are limited by the California-Nevada Interstate Water Compact and managed by a federal watermaster under a court decree. The drainage area of the West Fork Carson River upstream of the USGS gaging station near Woodfords is 65.40 square miles.

Development in the upper watershed includes campgrounds, Sorensen's Resort, a small subdivision, roads, and two inactive mines. At lower elevations the river passes through the communities of Woodfords and Paynesville. Highway 88 is located near the West

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Headwaters to Woodfords, Nitrogen
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Fork from Hope Valley to the state line. Near Woodfords, the watershed is still recovering from the impacts of wildfire. Cattle ranching is important in the lower section of the West Fork watershed, where pastures are irrigated with secondary wastewater effluent exported from the Lake Tahoe Basin.

Water Quality Objectives Violated

Water quality objectives for nitrogen in this segment of the West Fork Carson River, in milligrams per liter (mg/L), are as follows: Total Kjeldahl nitrogen, 0.13 mg/L; nitrate 0.02 mg/L, and total nitrogen, 15 mg/L. All objectives are expressed as “means of monthly means”; these are running averages incorporating historical data.

Evidence of Impairment

Regional Board staff calculated means of monthly means based on data collected by the South Tahoe Public Utility District at Woodfords between 1981 and 2000. (Total Kjeldahl N samples were available only since 1991.) For the Woodfords station, the current means of monthly means were as follows: total Kjeldahl N = 0.20 mg/L; nitrate (as N) = 0.04 mg/L; total N = 0.20. All of these values exceed the objectives.

Extent of Impairment

The reach of the river above Woodfords is recommended for listing.

Potential Sources

Scientific research in the Lake Tahoe Basin, to the north of the Carson River watershed, has shown that much of the nitrogen loading to Lake Tahoe comes from long distance transport and deposition from upwind sources. It is probable that similar nitrogen loading to the Carson River watershed is occurring. Local sources of nitrogen loading to this segment may include septic systems, erosion, stormwater, historic livestock grazing, and natural nitrogen fixation by plants and soil bacteria.

TMDL Priority.

This TMDL is recommended for high priority with completion after 2015.

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Headwaters to Woodfords, Nitrogen
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Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1983. *West Fork Carson River and Indian Creek Watersheds Water Quality Control Plan Update: 1983.*

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region.*

California Regional Water Quality Control Board, Lahontan Region 2001. Internal Memo from John Steude and Alan Miller to Judith Unsicker, *Summary of water quality analysis for potential CWA listing of the lower [sic] of the West Fork of the Carson River, Alpine County.*

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies.*

Murphy, D.M., and C.M. Knopp, editors, 2000. *Lake Tahoe Watershed Assessment.* Gen. Tech. Rep. PSW-GTR-176, USDA Forest Service, Pacific Southwest Research Station, Albany, CA, Vols. I and II.

South Tahoe Public Utility District. Unpublished water quality data.

**WEST FORK CARSON RIVER, HEADWATERS TO WOODFORDS, PERCENT
SODIUM
2002 Section 303(d) Fact Sheet
Listing**

Summary of Proposed Action

The segment of the West Fork Carson River upstream of Woodfords is proposed to be listed for violations of the narrative water quality objective for “Percent Sodium.”

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	West Fork Carson River	Pollutant(s)	Percent Sodium
Hydrologic Unit	West Fork Carson River (633.00)	Sources	Road salt, septic systems, natural
Total Length	~21 miles (in CA)	TMDL Priority	Medium
Size Affected	~15 miles	TMDL End Date	After 2015
Latitude/Longitude	38.778° N, 119.821°W	Original 303(d) Listing Year	2002

Watershed Characteristics

The East and West Forks of the Carson River are located in Alpine County. The forks join to form the Carson River near Genoa, Nevada. Both the East and West Forks originate on the eastern side of the Sierra Nevada in or near federal wilderness areas. Most of the California portion of the Carson River watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. The Carson River watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality.

The West Fork originates in the Lost Lakes and flows through scenic Hope Valley, where public funds have recently been spent to acquire important wetland/riparian habitat and a restoration project to address the impacts of historic (pre-1989) grazing is under way. There are several small lakes at the headwaters of the West Fork, some of which are managed as reservoirs to support irrigation in the lower watershed. Water diversions are limited by the California-Nevada Interstate Water Compact and managed by a federal watermaster under a court decree. The drainage area of the West Fork Carson River upstream of the USGS gaging station near Woodfords is 65.40 square miles.

Development in the upper watershed includes campgrounds, Sorensen’s Resort, a small subdivision, roads, and two inactive mines. At lower elevations the river passes through the communities of Woodfords and Paynesville. Highway 88 is located near the West Fork from Hope Valley to the state line. Near Woodfords, the watershed is still

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Headwaters to Woodfords, Percent Sodium
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recovering from the impacts of wildfire. Cattle ranching is important in the lower section of the West Fork watershed, where pasturelands are irrigated with secondary wastewater effluent exported from the Lake Tahoe Basin.

Water Quality Objectives Violated

The “percent sodium” objective is meant to protect crops against the impacts of excess sodium, which can damage soils and interfere with water uptake. It reflects the amount of sodium (Na) present in relation to the amounts of calcium (Ca), magnesium (Mg) and potassium (K). Percent sodium is computed as follows:

$$\frac{(\text{Na} \times 100)}{\text{Na} + \text{Ca} + \text{Mg} + \text{K}}$$

Concentrations of the above elements are expressed as milliequivalents per liter. Percent sodium has been superseded as an agricultural criterion by “Sodium Absorption Ratio,” which is calculated differently.

The “percent sodium” objective for the West Fork Carson River (20 percent expressed as a mean of monthly means) dates from the 1975 *Water Quality Control Plan for the North Lahontan Basin* and is based on a historic database of 114 samples collected at Woodfords. It is below the recommended criteria for irrigation (30-60 percent) available at the time the objective was last updated in 1983-84.

Evidence of Impairment

Regional Board staff calculated annual means of monthly means for percent sodium using data collected by the South Tahoe Public Utility District between 1981 and 2000. The figure for 2000 was 21.7 %.

Potential Sources

Possible anthropogenic sources of sodium in the upper West Fork watershed are road salt used on Highway 88 and wastewater disposed to septic systems.

TMDL Priority

This TMDL is recommended for a medium priority, with completion projected to occur after 2015 if a TMDL is still needed. It may be possible to ensure attainment of the objective before that time through source controls. Alternatively, Regional Board staff may consider revising the percent sodium objective to reflect current agricultural criteria.

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Headwaters to Woodfords, Percent Sodium
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Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1975. *Water Quality Control Plan for the North Lahontan Basin.*

California Regional Water Quality Control Board, Lahontan Region, 1983. *West Fork Carson River and Indian Creek Watersheds Water Quality Control Plan Update: 1983.*

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region.*

California Regional Water Quality Control Board, Lahontan Region 2001. Internal Memo from John Steude and Alan Miller to Judith Unsicker, Summary of water quality analysis for potential CWA listing of the lower [sic] of the West Fork of the Carson River, Alpine County.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies.*

South Tahoe Public Utility District. Unpublished water quality data.

**WEST FORK CARSON RIVER, WOODFORDS TO PAYNESVILLE, PERCENT
SODIUM
2002 Section 303(d) Fact Sheet
Listing**

Summary of Proposed Action

The segment of the West Fork Carson River between Woodfords and Paynesville is proposed to be listed for violations of the water quality objective for “percent sodium.”

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	West Fork Carson River	Pollutant(s)	Percent Sodium
Hydrologic Unit	West Fork Carson River (633.00)	Sources	Road salt, septic systems, natural
Total Length	~21 miles (in CA)	TMDL Priority	Medium
Size Affected	~ 4 miles	TMDL End Date	After 2015
Latitude/Longitude	38.809° N, 119.778°W	Original 303(d) Listing Year	2002

Watershed Characteristics

The East and West Forks of the Carson River are located in Alpine County. The forks join to form the Carson River near Genoa, Nevada. Both the East and West Forks originate on the eastern side of the Sierra Nevada in or near federal wilderness areas. Most of the California portion of the Carson River watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. The Carson River watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality.

Development in the upper watershed includes campgrounds, Sorensen’s Resort, a small subdivision, roads, and two inactive mines. At lower elevations, the river passes through the communities of Woodfords and Paynesville. Highway 88 is located near the West Fork from Hope Valley to the state line. Near Woodfords, the watershed is still recovering from the impacts of wildfire.

Cattle ranching is important in the lower section of the West Fork watershed, where pasturelands are irrigated with secondary wastewater effluent exported from the Lake Tahoe Basin. Ranchers using effluent are under reclamation waste discharge requirements from the Lahontan Regional Board. Diversions from the West Fork occur at and below Woodfords and can significantly affect instream flows from Woodfords to the state line. Most diversions are for irrigation; however, the South Tahoe Public Utility District diverts water to maintain the level of Indian Creek Reservoir.

**West Fork Carson River,
Woodfords to Paynesville, Percent Sodium
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Water Quality Objectives Not Attained

The “percent sodium” objective is meant to protect crops against the impacts of excess sodium, which can damage soils and interfere with water uptake. It reflects the amount of sodium (Na) present in relation to the amounts of calcium (Ca), magnesium (Mg) and potassium (K). Percent sodium is computed as follows:

$$\frac{(\text{Na} \times 100)}{\text{Na} + \text{Ca} + \text{Mg} + \text{K}}$$

Concentrations of the above elements are expressed as milliequivalents per liter. Percent sodium has been superseded as an agricultural criterion by “Sodium Absorption Ratio”, which is calculated differently.

The “percent sodium” objective for the West Fork Carson River (20% expressed as a mean of monthly means) dates from the 1975 *Water Quality Control Plan for the North Lahontan Basin*, and is based on a historic database of 114 samples collected at Woodfords. It is below the recommended criteria for irrigation (30-60 percent) available at the time the objective was last updated in 1983-84.

Evidence of Impairment

The mean of monthly means percent sodium value calculated for the West Fork at Paynesville, using data collected by the South Tahoe Public Utility District between 1981 and 2000, was 23 percent.

Extent of Impairment

The proposed listing is for the segment of the river about 4 miles long between Woodfords and Paynesville. (There are no recent water quality data for the segment of the river between Paynesville and the state line. Due to agricultural diversions, this segment may dry up completely during dry years. The State of Nevada uses data collected at Paynesville to represent conditions at the state line.)

Potential Sources

In addition to sources mentioned for the upstream segment (road salt and wastewater disposed to septic systems), potential sources of sodium include irrigation with wastewater effluent, livestock wastes, and septic systems tributary to the lower segment.

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Woodfords to Paynesville, Percent Sodium
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TMDL Priority

This TMDL is recommended for a medium priority, with completion projected to occur after 2015 if a TMDL is still needed. It may be possible to ensure attainment of the objective before that time through source controls. Alternatively, Regional Board staff may consider revising the percent sodium objective to reflect current agricultural criteria.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1975. *Water Quality Control Plan for the North Lahontan Basin*.

California Regional Water Quality Control Board, Lahontan Region, 1983. *West Fork Carson River and Indian Creek Watersheds Water Quality Control Plan Update: 1983*.

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region*.

California Regional Water Quality Control Board, Lahontan Region 2001. Internal Memo from John Steude and Alan Miller to Judith Unsicker, Summary of water quality analysis for potential CWA listing of the lower [sic] of the West Fork of the Carson River, Alpine County.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies*.

Nevada Division of Environmental Protection, Bureau of Water Quality Planning. 2001. State of Nevada Surface Water Monitoring Network, Carson River Basin. Available on the Internet: <http://ndep.state.nv.us/bwqp/C9.html>.

South Tahoe Public Utility District. Unpublished water quality data.

**WEST FORK CARSON RIVER, WOODFORDS TO PAYNESVILLE,
NITROGEN
2002 Section 303(d) Fact Sheet
Listing**

Summary of Proposed Action

The segment of the West Fork Carson River between Woodfords and Paynesville is proposed to be Section 303(d) listed for violations of the water quality objectives for nitrate and total nitrogen.

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	West Fork Carson River	Pollutant(s)	Nitrogen
Hydrologic Unit	West Fork Carson River (633.00)	Sources	Pasture runoff, stormwater, erosion, atmospheric deposition
Total Length	~21 miles (in CA)	TMDL Priority	High
Size Affected	~4 miles	TMDL End Date	After 2015
Latitude/Longitude	38.809° N, 119.778°W	Original 303(d) Listing Year	2002

Watershed Characteristics

The East and West Forks of the Carson River are located in Alpine County and join to form the Carson River near Genoa, Nevada. Both the East and West Forks originate on the eastern side of the Sierra Nevada in or near federal wilderness areas. Most of the California portion of the Carson River watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. The Carson River watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality.

Development in the upper watershed includes campgrounds, Sorensen's Resort, a small subdivision, roads, and two inactive mines. At lower elevations the river passes through the communities of Woodfords and Paynesville. Highway 88 is located near the West Fork from Hope Valley to the state line. Near Woodfords, the watershed is still recovering from the impacts of wildfire. Cattle ranching is important in the lower section of the West Fork watershed, where pasturelands are irrigated with secondary wastewater effluent exported from the Lake Tahoe Basin. Ranchers using effluent are under reclamation waste discharge requirements from the Lahontan Regional Board. Diversions from the West Fork occur at and below Woodfords and can significantly affect instream flows from Woodfords to the state line. Most diversions are for irrigation; however, the South Tahoe Public Utility District diverts water to maintain the level of Indian Creek Reservoir.

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Woodfords to Paynesville, Nitrogen
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Water Quality Objectives Violated

For the Woodfords to Paynesville segment of the West Fork, the water quality objectives for nitrate (as N), total Kjeldahl nitrogen, and total nitrogen, in milligrams per liter (mg/L), are 0.03, 0.22, and 0.25 mg/L, expressed as means of monthly means. (These are running averages incorporating historic data.) The Regional Board's 1983 Basin Plan staff report noted higher nutrient concentrations and agricultural impacts on water quality in this reach of the river.

Evidence of Impairment

Staff calculated means of monthly means using data collected by the South Tahoe Public Utility District between 1981 and 2000. Means of monthly means for nitrate (as N), total Kjeldahl nitrogen, and total nitrogen were 0.06 mg/L, 0.21 mg/L, and 0.27 mg/L. The means of monthly means for nitrate and total nitrogen exceeded the water quality objectives.

Extent of Impairment

The reach of the West Fork Carson River between Woodfords and Paynesville is recommended for listing.

Potential Sources

In addition to the upstream sources causing violation of objectives at Woodfords (atmospheric deposition, septic systems, erosion, stormwater, grazing, and natural fixation by plants and soil bacteria), this reach of the river is affected by agricultural stormwater. Data for total and fecal coliform bacteria in this reach indicate that livestock wastes are affecting the river. Floodwaters from the severe January 1997 storm event may also have affected nutrient concentration in the river.

TMDL Priority

This TMDL is recommended for high priority, with completion projected to occur after 2015.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1983. *West Fork Carson River and Indian Creek Watersheds Water Quality Control Plan Update: 1983.*

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California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region*.

California Regional Water Quality Control Board, Lahontan Region 2001. Internal Memo from John Steude and Alan Miller to Judith Unsicker, Summary of water quality analysis for potential CWA listing of the lower [sic] of the West Fork of the Carson River, Alpine County.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies*.

Murphy, D.M., and C.M. Knopp, editors, 2000. *Lake Tahoe Watershed Assessment*. Gen. Tech. Rep. PSW-GTR-176, USDA Forest Service, Pacific Southwest Research Station, Albany, CA, Vols. I and II.

Nevada Division of Environmental Protection, Bureau of Water Quality Planning. 2001. State of Nevada Surface Water Monitoring Network, Carson River Basin. Available on the Internet: <http://ndep.state.nv.us/bwqp/C9.html>.

South Tahoe Public Utility District. Unpublished water quality data.

**WEST FORK CARSON RIVER, WOODFORDS TO PAYNESVILLE,
PATHOGENS
2002 303(d) Fact Sheet
Listing**

Summary of Proposed Action

The segment of the West Fork Carson River between Woodfords and the California-Nevada state line is proposed to be listed for “pathogens” due to violations of the water quality objective for fecal coliform bacteria. Fecal coliform bacteria in water are indicators of contamination from the feces of warm-blooded animals, and of the possible presence of many different kinds of pathogenic microorganisms.

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	West Fork Carson River	Pollutant(s)	Pathogens
Hydrologic Unit	West Fork Carson River (633.00)	Sources	Livestock, wildlife
Total Length	~21 miles (in CA)	TMDL Priority	Medium
Size Affected	~4 miles	TMDL End Date	After 2015
Latitude/Longitude	38.809° N, 119.778°W	Original 303(d) Listing Year	2002

Watershed Characteristics

The East and West Forks of the Carson River are located in Alpine County. The forks join to form the Carson River near Genoa, Nevada. Both the East and West Forks originate on the eastern side of the Sierra Nevada in or near federal wilderness areas. Most of the California portion of the Carson River watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. The Carson River watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality.

Development in the upper watershed includes campgrounds, Sorensen’s Resort, a small subdivision, roads, and two inactive mines. At lower elevations, the river passes through the communities of Woodfords and Paynesville. Highway 88 is located near the West Fork from Hope Valley to the state line. Near Woodfords, the watershed is still recovering from the impacts of wildfire. Cattle ranching is important in the lower section of the West Fork watershed, where pasturelands are irrigated with secondary wastewater effluent exported from the Lake Tahoe Basin. Ranchers using effluent are under reclamation waste discharge requirements from the Lahontan Regional Board. Diversions from the West Fork occur at and below Woodfords, and can significantly affect instream flows from Woodfords to the state line. Most diversions are for irrigation; however, the

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Woodfords to State Line, Pathogens
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South Tahoe Public Utility District diverts water to maintain the level of Indian Creek Reservoir.

Water Quality Objectives Violated

The regionwide narrative water quality objective for coliform bacteria in surface waters of the Lahontan Basin Plan states:

“Waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes.

The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 ml, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100 ml.”

The units used in the water quality objective are the numbers of bacterial colonies per 100 milliliters (ml), sometimes referred to as the “Most Probable Number” or MPN.

This objective applies to all surface waters of the Lahontan Region. Because the South Tahoe Public Utility District’s Alpine County monitoring program involves monthly sampling, the 40/100 ml limit in the last part of the objective was the criterion used in assessment for update of the Section 303(d) list.

The Lahontan Basin Plan does not currently include water quality objectives for fecal streptococci. However, these bacteria are also indicators of fecal pollution and therefore of impairment. Fecal streptococci can be used to assess sources of contamination. If the ratio of fecal coliform numbers to fecal streptococcus numbers is greater than 4, a human source is generally indicated, and a ratio of less than 0.7 points to animal sources.

Evidence of Impairment

Samples collected at Woodfords by the South Tahoe Public Utility District (STPUD) between June 2000 and May 2001 had no violations of the fecal coliform objective. Colony numbers ranged from <3 to <30/ml. Fecal streptococcus were detected, at 30/ml, on two out of ten sampling dates. Table 2 summarizes data for total coliform, fecal coliform, and fecal streptococcus bacteria in the West Fork Carson River at Paynesville, from samples collected by the STPUD in 2000-2001. Violations of the fecal coliform objective occurred in four of the ten months sampled. Numbers of total and fecal coliform bacteria were higher during the summer grazing season.

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Woodfords to State Line, Pathogens
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Table 2. South Tahoe Public Utility District Monitoring Data for Bacteria, West Fork Carson River at Paynesville (colonies per 100 ml).

Sampling date	Total coliform	Fecal Coliform	Fecal streptococcus
Paynesville (SW05)			
06/06/00	430	430	-
07/05/00	430	40	-
08/01/00	390	230	-
09/05/00	430	30	-
10/03/00	430	90	-
11/01/00	390	40	30
12/05/00	23	4	-
03/06/01	93	4	-
04/03/01	43	<3	-
05/01/01	43	43	40
Stateline (SW06)			
06/06/00	430	230	
07/05/00	230	40	-
08/01/00	11,000	430	-
09/05/00	150	90	-
10/03/00	140	140	-
11/01/00	750	40	<30
12/05/00	-	-	-
03/06/01	93	3	-
04/03/01	43	9	-
05/01/01	230	23	230

The Nevada Division of Environmental Protection samples water quality at the Paynesville station every other month (six times per year). Data for 1997 and 1998 are summarized in Table 3. These data are not directly comparable with the fecal coliform bacteria data summarized above. However, the high numbers occurring during the summer indicate the probable impacts of livestock wastes and pasture runoff.

Table 3. Nevada Division of Environmental Protection Monitoring Data for Bacteria, West Fork Carson River at Paynesville (Most Probable Number [of colonies] per 100 ml).

Sampling Date	Fecal Streptococcus	E. coli
14 Jan 1997	<10	<10
12 Mar 1997	<10	10
28 May 1997	30	10
22 July 1997	170	99
16 Sep 1997	10	31
12 Nov 1997	40	<10
14 Jan 1998	<10	<10
17 March 1998	<10	31
26 May 1998	20	<10
21 July 1998	230	87
15 Sep 1998	110	530
17 Nov 1998	40	75

**West Fork Carson River,
Woodfords to State Line, Pathogens
2002 Section 303(d) Fact Sheet, Page 4**

Extent of Impairment

The segment of the West Fork Carson River between Woodfords and the California-Nevada state line is recommended for listing.

Potential Sources

The primary source of fecal coliform bacteria in the West Fork is probably livestock wastes. Wildlife and recreational users of the watershed may also be sources. Bacteria are monitored in the lower West Fork Carson River watershed because of public concern about the impacts of irrigation with secondary effluent. However, the effluent is disinfected and is not likely to be the source of the violations.

TMDL Priority

This TMDL is recommended for a medium priority, with completion projected after 2015. Management practices for irrigation and grazing in this watershed are expected to change as a result of ongoing watershed planning activities for the Carson River watershed, and the Regional Board's nonpoint source program. If these practices are successful, it may be possible to delist this segment of the river instead of developing a TMDL.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region*.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies*.

Menon, A.S., 2001. *Shellfish Safety: Bacterial Indicators on [sic] Shellfish Water Quality*. *Canadian Shellfish Quality Resource*. Available on the Internet: <<http://www.shellfishquality.ca/indicators.htm>>.

Nevada Division of Environmental Protection, Bureau of Water Quality Planning. 2001. State of Nevada Surface Water Monitoring Network, Carson River Basin. Available on the Internet: <http://ndep.state.nv.us/bwqp/C9.html>

South Tahoe Public Utility District. Unpublished water quality data.

EAST FORK CARSON RIVER, NUTRIENTS
2002 Section 303(d) Fact Sheet
Delisting

Rationale for Delisting

The East Fork Carson River is recommended for removal from the Section 303(d) list because the original listing was done on the mistaken assumptions by Regional Board staff, and there is no current evidence of impairment by nutrients in California. The river was listed for nutrients in the 1980s because the State of Nevada had listed it for violations of pH criteria in a reach beginning at the state line. (Increases in pH can result indirectly from algae blooms, which in turn result from high levels of nutrients and warm temperatures. The pH violations were probably connected to the drought of the late 1980s and early 1990s.) Nevada subsequently removed this water body/pollutant combination from its 303(d) list, and the current (1998) Nevada list does not include it. Nevada's online monitoring data for the Carson River watershed show that the reach beginning at the state line is monitored at the Riverview Mobile Home Park (Latitude 38°52'22", Longitude 119°41' 20") south of Gardnerville near Highway 395, which is about 12-13 miles downstream from the California state line. Data for pH at the Riverview station should not be assumed to be representative of conditions in California at the state line. The reach above the mobile home park probably receives nutrients from Indian Creek and from agricultural runoff, septic systems, and stormwater in Nevada, and river pH will be influenced by local algal productivity. (This reach of the river also receives inflow on the Nevada side of the state line from Bryant Creek, which is affected by acid mine drainage.)

Samples collected at the Riverview station between March 12, 1997 and May 29, 2001 had laboratory pH values ranging from 7.02 to 8.5, and field pH values ranging from 6.32 to 8.7. None of the 24 laboratory pH measurements taken during this period exceeded the California water quality objective (6.5-8.5 units). Four of the 26 field pH measurements were higher than 8.5 units and one was lower than 6.5. Even if the Riverview station were representative of conditions at the state line, the deviations from the California standard are not great enough to affect beneficial uses, and Lahontan Regional Board staff would not recommend listing on the basis of the current data.

Watershed Conditions

The East and West Forks of the Carson River are located in Alpine County, south of Lake Tahoe. The forks join to form the Carson River near Genoa, Nevada. Several tributaries, including Indian Creek and Bryant Creek, cross the California-Nevada state line separately from the main forks. Both the East and West Forks originate in the upper reaches of the eastern side of the Sierra Nevada in or near federal wilderness areas. The watershed is popular for sport fishing, rafting, and other outdoor recreation activities which depend on high water quality. A segment of the East Fork between Hangman's Bridge and the Nevada state line is designated as a State Wild and Scenic River, and is a

East Fork Carson River, Nutrients

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popular river rafting area. Some reaches of the East Fork are under study for possible inclusion in the federal Wild and Scenic River system. The watershed supports two subspecies of threatened trout, the Lahontan and Paiute cutthroat trout.

Most of the California portion of the watershed is in public ownership, and the local economy depends heavily on tourism. The watershed also includes lands of the Washoe Tribe of California and Nevada. Cattle ranching is important in the lower sections of the East and West Fork watersheds, and grazing on rangeland extends to the upper watersheds. The East Fork Carson River watershed has also been disturbed by historic logging, grazing, and mining. State Highways 89 and 4 are located close to the river and its tributaries. Water diversions in the Carson River watershed are limited by the California-Nevada Interstate Water Compact and a court decree.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region*.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies*.

Nevada Division of Environmental Protection, Bureau of Water Quality Planning. 1998. Nevada's 1998 303(d) List. Available on the Internet:
<http://ndep.state.nv.us/bwqp/riv303d98.pdf>.

Nevada Division of Environmental Protection, Bureau of Water Quality Planning. 2001. State of Nevada Surface Water Monitoring Network, Carson River Basin. Available on the Internet: <http://ndep.state.nv.us/bwqp/C9.html>.

MONITOR CREEK, METALS

2002 Section 303(d) Fact Sheet

Clarification

Summary of Proposed Action

Monitor Creek, a tributary of the East Fork Carson River in Alpine County (Hydrologic Unit No. 632.10), is currently Section 303(d)-listed for “metals.” Regional Board staff used this term to cover overall impairment of the creek by acid mine drainage, including impacts on instream beneficial uses. Since staff’s current approach is to be more specific about the nature of impairment, the “metals” listing is proposed to be replaced by separate entries for iron, silver, aluminum, and manganese, to reflect the individual pollutants which currently appear to be affecting beneficial uses. (Separate new listings are proposed for two non-metallic pollutants, sulfate and total dissolved solids, which are also related to the acid mine drainage problem.) If further monitoring shows that listings for different metals are warranted, the list will be revised during the next (2004) update cycle.

Watershed Characteristics

Monitor Creek is located in eastern Alpine County (latitude 38.66°N, longitude 119.73°W). Monitor Creek (about 4 miles long) originates near Monitor Pass as Heenan Creek (about 2 miles long), which is impounded by Heenan Reservoir. Releases from the reservoir are made for irrigation in Nevada. Heenan Reservoir is used by the California Department of Fish and Game as rearing habitat and a catch-and-release fishery for the threatened Lahontan cutthroat trout. The Heenan Creek watershed is used for grazing. Monitor Creek joins the East Fork Carson River near the junction of State Highways 4 and 89, and the creek runs near Highway 89 for most of its length.

The Monitor Creek watershed includes altered and unaltered Pliocene volcanic rocks, with zones of silicification and intrusion containing gold, silver, copper, lead, zinc, antimony, arsenic, barite and manganese in complex, high-sulfide ores. Monitor Creek has been affected by mining since the Comstock era in the 1860s. (“Monitor” refers to the water cannons formerly used for hydraulic mining, and it was the name of a mining town in the watershed which existed from about 1863-1911.) There are a number of inactive mines in the Colorado Hill area to the north of the creek, and tailings from an inactive ore mill are located within the creek. There are currently no active mines in the watershed; most of the land is within U.S. Forest Service ownership.

Water Quality Standards Not Attained

In California, water quality standards include designated beneficial uses and narrative or numerical water quality objectives, equivalent to federal “criteria,” established to protect those uses. Monitor Creek is designated for a variety of uses, including municipal, recreational, and aquatic life uses. Because of the presence of Lahontan cutthroat trout, it is also designated for the Rare, Threatened, or Endangered Species Habitat use.

Monitor Creek, Metals

2002 Section 303(d) Fact Sheet, Page 2

The water quality objectives applicable to Monitor Creek that apply to metals in acid mine drainage include: (1) narrative objectives for nondegradation, chemical constituents, color, settleable materials, toxicity, and turbidity, and (2) numerical objectives for metals in the U.S. Environmental Protection Agency's California Toxics Rule. The narrative objective for "chemical constituents" references the California Department of Health Services' Maximum Contaminant Levels (MCLs) for drinking water. The narrative objective for "settleable materials" provides that:

"Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or that adversely affects the water for beneficial uses. For natural high quality waters, the concentrations of settleable materials shall not be raised by more than 0.1 milliliter per liter."

Evidence of Impairment

A Section 205(j)-funded study of the chemistry and biology of Monitor Creek was done by University of Nevada researchers in 1990-91. It showed that **iron** levels immediately below the Zaca Mine adit may regularly exceed the USEPA freshwater aquatic life chronic exposure criterion (1 milligrams per liter or mg/L). "Biologically available iron" concentrations from four sampling runs ranged from 1-3 mg/L. The study report observed that the reach below several tailings piles and drainage from the Zaca Mine adit was affected by a reddish-brown precipitate, possibly ferric sulfate.

The study also indicated, based on one sampling run, that the chronic exposure criterion for **silver** may be exceeded at stations throughout Monitor Creek. The values ranged from 0.2-0.7 mg/L, compared to a criterion of 0.12 mg/L. (Silver concentrations in samples from the East Fork Carson River upstream and downstream of Monitor Creek were comparable to those in the creek.) Elevated silver was observed in one Toxic Substances Monitoring Program sample of fish tissue from Monitor Creek.

An **aluminum** sample taken by Western States Minerals Corporation just above the confluence of Monitor Creek with the East Fork Carson River had a concentration of 0.4 mg/L, compared to the EPA chronic toxicity criterion of 0.087 mg/L. **Manganese** in Monitor Creek may exceed the federal and state drinking water MCL of 0.05 mg/L.

The Section 205(j) study showed a number of impacts on **beneficial uses**. The lowest mean algal chlorophyll a, carotenoid, and phaeopigment concentrations were found at stations below the mine tailings and Zaca Mine adit. Benthic invertebrate numbers and diversity were lower in Monitor Creek than in the East Fork Carson River. Station M2, below the Zaca mine adit, had the lowest species richness and numbers and was "nearly devoid of benthos during most samples." These adverse impacts on beneficial uses are probably related to the physical impacts of metal precipitates.

Monitor Creek, Metals

2002 Section 303(d) Fact Sheet, Page 3

Extent of Impairment

Indicators of impairment increase downstream in Monitor Creek, and worsen below the Zaca Mine adit. The entire creek (below Heenan Reservoir) is currently listed for metals, and the proposed revised listings for separate metals and settleable solids will cover the same segment.

Potential Sources

The primary source of metals is believed to be acid drainage from inactive mines, millsites and tailing piles. There may be some contribution from natural erosion from undisturbed portions of the watershed.

TMDL Priority

The Monitor Creek metals problem is currently assigned a “High” priority with TMDL completion projected in 2011. It is likely that TMDLs for all of the pollutants associated with acid mine drainage will be coordinated as one set of Basin Plan amendments.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region*.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies*.

California Regional Water Quality Control Board, Lahontan Region, 2001. Email from Jason Churchill to Judith Unsicker, Monitor Creek 303(d) Listing, October 12, 2001.

California State Water Resources Control Board, Toxic Substances Monitoring Program database.

Vinyard, G.L., and R.W. Watts, 1992. *Wasteload Allocation Study, Monitor Creek, East Fork Carson River Hydrologic Unit*. Aquatic Ecology Laboratory, University of Nevada, Reno.

MONITOR CREEK, SULFATE
2002 Section 303(d) Fact Sheet
Listing

Summary of Proposed Action

Monitor Creek, a tributary of the East Fork Carson River that is already listed for metals, is proposed to be listed for sulfate.

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	Monitor Creek	Pollutant(s)	Sulfate
Hydrologic Unit	East Fork Carson River, 632.10	Sources	Acid mine drainage, erosion
Total Length	4 miles	TMDL Priority	High
Size Affected	4 miles	TMDL End Date	After 2015
Latitude/Longitude	38.658°N, 119.725°W	Original 303(d) Listing Year	2002

Watershed Characteristics

Monitor Creek is located in eastern Alpine County. It originates near Monitor Pass as Heenan Creek (about 2 miles long), which is impounded by Heenan Reservoir. Releases from the reservoir are made for irrigation in Nevada. Heenan Reservoir is used by the California Department of Fish and Game as rearing habitat and a catch-and-release fishery for the threatened Lahontan cutthroat trout. The Heenan Creek watershed is used for grazing. Monitor Creek joins the East Fork Carson River near the junction of State Highways 4 and 89, and the creek runs near Highway 89 for most of its length.

The Monitor Creek watershed includes altered and unaltered Pliocene volcanic rocks, with zones of silicification and intrusion containing gold, silver, copper, lead, zinc, antimony, arsenic, barite and manganese in complex, high sulfide ores. Monitor Creek has been affected by mining since the Comstock era in the 1860s. ("Monitor" refers to the water cannons formerly used for hydraulic mining, and it was the name of a mining town in the watershed which existed from about 1863-1911.) There are a number of inactive mines in the Colorado Hill area to the north of the creek, and tailings from an inactive ore mill are located within the creek. There are currently no active mines in the watershed; most of the land is within U.S. Forest Service ownership.

Water Quality Objectives Violated

The water quality objectives for sulfate in the East Fork Carson River and its tributaries are 4.0 milligrams per liter (mg/L) as an annual mean and 8.0 mg/L as an annual 90th percentile level. The state drinking water Secondary Maximum Contaminant Level for sulfate (250 mg/L) also applies under the "Chemical Constituents" objective.

Monitor Creek, Sulfate

2002 Section 303(d) Fact Sheet, Page 2

Evidence of Impairment

During the 1990-91 Section 205(j) study, the mean values of sulfate at 6 of 7 sampling stations in Monitor Creek exceeded 100 mg/L, with maximum values of about 800 mg/L at a station below the Zaca Mine adit and 700 mg/L at the creek's confluence with the East Fork Carson River.

Violations of the pH objective (6.5 to 8.5 pH units), presumed to come from sulfuric acid, occur near the discharge from the Zaca Mine adit. A separate listing for "pH" is not being proposed, since it is assumed that control of acid mine drainage, including sulfate, will address the pH problem.

Extent of Impairment

The segment of the creek between Heenan Reservoir and the confluence with the East Fork Carson River is proposed for listing.

Potential Sources

The major source of sulfate loading to Monitor Creek is assumed to be acid mine drainage.

TMDL Priority

This TMDL is recommended for high priority. The sulfate problem in Monitor Creek will likely be addressed through the CERCLA cleanup process. If a separate TMDL seems necessary after completion of the TMDLs for metals, it will be completed after 2015.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1995. Water Quality Control Plan for the Lahontan Region.

California Regional Water Quality Control Board, Lahontan Region, 2001. Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies.

Vinyard, G.L, and R.W. Watts, 1992. Wasteload Allocation Study, Monitor Creek, East Fork Carson River Hydrologic Unit. Aquatic Ecology Laboratory, University of Nevada, Reno.

MONITOR CREEK, TOTAL DISSOLVED SOLIDS
2002 Section 303(d) Fact Sheet
Listing

Summary of Proposed Action

Monitor Creek, a tributary of the East Fork Carson River that is already listed for metals, is proposed to be listed for total dissolved solids (TDS).

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	Monitor Creek	Pollutant(s)	Total dissolved solids
Hydrologic Unit	East Fork Carson River (632.10)	Sources	Acid mine drainage, etc.
Total Length	4 miles	TMDL Priority	High
Size Affected	4 miles	TMDL End Date	After 2015
Latitude/Longitude	38.658°N, 119.725°W	Original 303(d) Listing Year	2002

Watershed Characteristics

Monitor Creek is located in eastern Alpine County. It originates near Monitor Pass as Heenan Creek (about 2 miles long), which is impounded by Heenan Reservoir. Releases from the reservoir are made for irrigation in Nevada. Heenan Reservoir is used by the California Department of Fish and Game as rearing habitat and a catch-and-release fishery for the threatened Lahontan cutthroat trout. The Heenan Creek watershed is used for grazing. Monitor Creek joins the East Fork Carson River near the junction of State Highways 4 and 89, and the creek runs near Highway 89 for most of its length.

The Monitor Creek watershed includes altered and unaltered Pliocene volcanic rocks, with zones of silicification and intrusion containing gold, silver, copper, lead, zinc, antimony, arsenic, barite and manganese in complex, high sulfide ores. Monitor Creek has been affected by mining since the Comstock era in the 1860s. ("Monitor" refers to the water cannons formerly used for hydraulic mining, and it was the name of a mining town in the watershed which existed from about 1863-1911.) There are a number of inactive mines in the Colorado Hill area to the north of the creek, and tailings from an inactive ore mill are located within the creek. There are currently no active mines in the watershed; most of the land is within U.S. Forest Service ownership.

Water Quality Objectives Not Attained

The numerical water quality objectives for total dissolved solids for the East Fork Carson River and its tributaries are 80 milligrams per liter (mg/L) as an annual mean, and 100

Monitor Creek, Total Dissolved Solids 2002 Section 303(d) Fact Sheet, Page 2

mg/L as an annual 90th percentile level. The drinking water Secondary Maximum Contaminant Level (500 mg/L for TDS) also applies under the “Chemical Constituents” objective.

Evidence of Impairment

During a 1990-91 Section 205 (j) study (Vinyard and Watts, 1992), mean values of TDS exceeded the objective at all stations, and mean values above 500 mg/L occurred at 4 of 7 stations. Maximum values over 1000 mg/L were recorded at stations below mine tailings and the Zaca Mine adit.

Extent of Impairment

The segment of Monitor Creek between Heenan Reservoir and the confluence with the East Fork Carson River is proposed for listing.

Potential Sources

Sulfate from acid mine drainage probably accounts for most of the TDS loading. Other possible sources are erosion, stormwater (i.e., including road salt applied to Highway 89), and releases from Heenan Reservoir.

TMDL Priority

This TMDL is recommended for high priority. The total dissolved solids problem will likely be addressed through the CERCLA cleanup process. If a separate TMDL for total dissolved solids is needed after completion of TMDLs for metals, it will be completed after 2015.

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region*.

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies*.

Vinyard, G.L., and R.W. Watts, 1992. *Wasteload Allocation Study, Monitor Creek, East Fork Carson River Hydrologic Unit*. Aquatic Ecology Laboratory, University of Nevada, Reno.

INDIAN CREEK, PATHOGENS
2002 Section 303(d) Fact Sheet
Listing

Summary of Proposed Action

Indian Creek, in the East Fork Carson River watershed, is recommended to be listed for “pathogens” due to violations of the water quality objective for fecal coliform bacteria. Fecal coliform bacteria in water are indicators of contamination from the feces of warm-blooded animals and of the possible presence of many different kinds of pathogenic microorganisms.

Table 1. 303(d) Listing/TMDL Information

Waterbody Name	Indian Creek	Pollutant(s)	Pathogens
Hydrologic Unit	East Fork Carson River (632.20)	Sources	Livestock, wildlife
Total Length	~17 miles (10 in CA)	TMDL Priority	Medium
Size Affected	~7 miles	TMDL End Date	After 2015
Latitude/Longitude	38.885° N, 119.702° W	Original 303(d) Listing Year	2002

Watershed Characteristics

Indian Creek, in Alpine County, is a tributary of the East Fork Carson River that crosses the California State Line separately from the main East Fork. Its headwaters are on National Forest land west of State Highway 89 between Woodfords and Markleeville. There are several small tributaries of Indian Creek. Indian Creek flows through irrigated pasture in Diamond and Dutch Valleys in California, and Long Valley in Nevada, and joins the East Fork Carson River near Dresslerville, Nevada. Some of the water from the creek enters Mud Lake, Nevada. The main channel of the creek has been routed beneath Harvey Place Reservoir within a pipe. Indian Creek Reservoir, which formerly stored treated wastewater exported from the Lake Tahoe Basin, was constructed on a tributary of Indian Creek, and discharges from this reservoir currently reenter the main channel of Indian Creek east of Harvey Place Reservoir.

The main land use in the Indian Creek watershed in California and Nevada is agriculture. Pastures are irrigated with water diverted from Indian Creek and the West Fork Carson River and with secondary wastewater effluent exported from South Lake Tahoe and stored in Harvey Place Reservoir. The U.S. Bureau of Land Management manages a recreation area surrounding the reservoir, including a campground, boat ramps, and day use facilities.

Indian Creek, Pathogens

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Water Quality Objectives Not Attained

The water quality objective for coliform bacteria in surface waters of the Lahontan Basin Plan states:

“Waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes.

The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 ml, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100 ml.”

The units used in the water quality objective are the numbers of bacterial colonies per 100 milliliters (ml), sometimes referred to as the “Most Probable Number” or MPN.

This objective applies to all surface waters of the Lahontan Region. Because the South Tahoe Public Utility District’s Alpine County monitoring program involves monthly sampling, the 40/100 ml limit in the last part of the objective was the criterion used in assessment for update of the Section 303(d) list.

The Lahontan Basin Plan does not currently include specific water quality objectives for *E. coli* or fecal streptococci. However, these bacteria are also indicators of fecal pollution and therefore of impairment. Fecal streptococci can be used to assess sources of contamination. If the ratio of fecal coliform numbers to fecal streptococcus numbers is greater than 4, a human source is generally indicated, and a ratio of less than 0.7 points to animal sources.

Evidence of Impairment

Table 2 below summarizes data collected by the South Tahoe Public Utility District at three stations on Indian Creek between June 2000 and May 2001. Violations of the water quality objective for fecal coliform bacteria occurred at all three stations. Fecal coliform numbers were highest during the summer and early fall months, during the grazing-irrigation season.

Potential Sources

The primary source of fecal coliform bacteria in Indian Creek is probably livestock wastes. Wildlife and recreational users of the watershed may also be sources. Bacteria are monitored in the Indian Creek watershed because of public concern about the impacts of irrigation with secondary effluent. However, the effluent is disinfected and is not likely to be the source of the violations.

Indian Creek, Pathogens
2002 Section 303(d) Fact Sheet, Page 3

Table 2. South Tahoe Public Utility District Monitoring Data for Bacteria in Indian Creek (Most Probable Number [colonies] per 100 ml). Shaded rows indicate different stations in upstream to downstream order.

Sampling Date	Total Coliform	Fecal Coliform	Fecal Streptococcus
SWO2			
06/06/00	<30	<30	-
07/05/00	230	40	-
08/01/00	930	90	-
09/05/00	930	430	-
10/03/00	70	30	-
11/01/00	40	40	-
12/05/00	93	43	-
03/06/01	43	3	-
04/03/01	15	<3	-
05/01/01	43	9	90
SWO3			
06/06/00	430	430	-
07/05/00	2400	930	-
08/01/00	4600	2400	-
09/05/00	90	40	-
10/03/00	40	40	-
11/01/00	930	430	150
12/05/00	-	-	-
03/06/01	43	<31	-
04/03/01	43	43	-
05/01/01	43	9	150
SWO4			
06/06/00	2400	930	
07/05/00	90	90	
08/01/00	1500	230	
09/05/00	4600	30	
10/03/00	930	150	
11/01/00	390	230	40
12/05/00	-	-	
03/06/01	9	3	
04/03/01	9	9	
05/01/01	43	15	430

TMDL Priority

This TMDL is recommended for a medium priority, with completion projected after 2015. Management practices for irrigation and grazing in this watershed are expected to change as a result of ongoing watershed planning activities for the Carson River watershed, and the Regional Board's nonpoint source program. If these practices are successful, it may be possible to delist Indian Creek instead of developing a TMDL.

Indian Creek, Pathogens
2002 Section 303(d) Fact Sheet, Page 4

Information Sources

California Regional Water Quality Control Board, Lahontan Region, 1983. *West Fork Carson River and Indian Creek Watersheds Water Quality Control Plan Update: 1983.*

California Regional Water Quality Control Board, Lahontan Region, 1995. *Water Quality Control Plan for the Lahontan Region.*

California Regional Water Quality Control Board, Lahontan Region, 2001. *Staff Report on Recommended Changes to Lahontan Region's Section 303(d) List of Impaired Surface Water Bodies.*

Menon, A.S., 2001. *Shellfish Safety: Bacterial Indicators on [sic] Shellfish Water Quality. Canadian Shellfish Quality Resource.* Available on the Internet: <<http://www.shellfishquality.ca/indicators.htm>>.

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South Tahoe Public Utility District. Unpublished water quality data.